

# Investigation of Compressive Strength and Permeability of Pervious Concrete Pavements for Urban Groundwater Recharge

<sup>1</sup>Vijay Kumar Shukla, <sup>2</sup>Pankaj Sidar, <sup>3</sup>Kamlesh Ratre

<sup>1</sup>Assistant professor, Civil Engineering Department,

<sup>2,3</sup>Assistant professor, Mechanical Engineering Department

VEC Ambikapur, Chhattisgarh, India

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**Abstract:** Due to urbanization surface of earth is covered by structures. Rain water does not percolate and ground water recharge is not possible. Therefore some method used for ground water recharge by changing some properties of concrete. One of these methods is PERVIOUS CONCRETE. When the pervious concrete is used for pavement construction rain water recharges into earth surface but the strength of concrete to bear the load of vehicles and living organism is also primary consideration therefore in this investigation the compressive strength of concrete is tested. Grade of concrete used in this investigation is M15, M20 and M25. All test of cement and aggregate was done by using IS Code.

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## 1. INTRODUCTION

Pervious concrete is types of concrete having large voids which make it highly permeable. This is concrete in which sand is omitted from aggregate portion. Pervious concrete allow rainwater to directly pass through their voids, reduce runoff, and increase ground water. Pervious concrete used for various purposes but primarily used as pavement is beneficial in urban area as well as rural road development. Pervious concrete having zero slump and open graded coarse aggregate is used. Sometime pervious concrete is referred as “no – fine” concrete.

## 2. LITERATURE REVIEW

The Literature available for pervious concrete give different conclusion about pervious concrete. Research paper by Darshan S. Shah, Prof. Jayeshkumar Pitroda, Prof.J.J.Bhavsar paper entitled “Pervious Concrete: New Era For Rural Road Pavement” concluded that the pervious concrete is suitable to meet the rural area requirement such as to reduce the storm water runoff, to increase the ground water level, to eliminate the costly storm water management practices. Paper by An Cheng, Hui-Mi Hsu, Sao-Jeng Chao, and Kae-Long Lin paper entitled “Experimental Study on Properties of Pervious Concrete Made with Recycled Aggregate” concluded that the density of concrete using recycled aggregate is less than natural aggregate concrete.

## 3. MATERIAL AND METHOD

### 3.1 Cement

Ordinary Portland cement of 43 grades. Specific gravity of cement is 3.15 (standard).

### 3.2 Aggregates

Open graded coarse aggregate used with maximum size of aggregate 20mm. The specific gravity of coarse aggregate used in investigation is 2.72.

### 3.3 Water

Potable water used for experiment.

## 4. Advnatages of Pervious Concrete

1. Efficient land development.
2. Reduces the rain water runoff.
3. Increases height of water table.
4. No needs of detention ponds

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| <ol style="list-style-type: none"> <li>1. As a road pavement</li> <li>2. Stabilization of slopes</li> <li>3. Footpath</li> </ol> | <ol style="list-style-type: none"> <li>4. In parking lots.</li> <li>5. Swimming pool decks</li> <li>6. Noise barriers</li> </ol> |
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## 6. EXPERIMENTAL INVESTIGATION

### 6.1 Table for Grade of concrete

S.N.	Grade of concrete	Proportioning for normal concrete (cement:sand:aggregate)	Proportioning for pervious concrete (Cement: aggregate)
1	M15	1:2:4	1:6
2	M20	1:1.5:3	1:4.5
3	M25	1:1:2	1:3

### 6.2 TEST PROGRAM

**Batching** – Batching is the process of measuring of materials for making concrete. Weight batching is used for this experiment.

**Mixing** – Mixing is the process in which all ingredient of concrete is mixed thoroughly with water until a homogeneous paste is formed. Water cement ratio used in this experiment is 0.45.

**Casting** – Casting is generally referred as molding of concrete Mould of size 150mm x 150 mm x150mm are used for compression test of concrete.



**Figure 1 Compression Test of Pervious Concrete**

**Compaction** – Compaction is done to remove the air voids present in concrete. Mould is fill in three layers. Each layers is compacted by 25 times by using tamping rod.

**Curing** - Mould is cured for 28 days for the completion of hydration process and reduction of heat of hydration.

**Testing** – **Compression test**

The compression test of pervious concrete cubes is determined using a compression testing machine of capacity 2000KN. Test is done According to IS516:1959. Rate of application of load is 140Kg/cm<sup>2</sup>/minute.

### 7. TEST RESULT

#### Compressive strength of pervious concrete (3 days curing) -

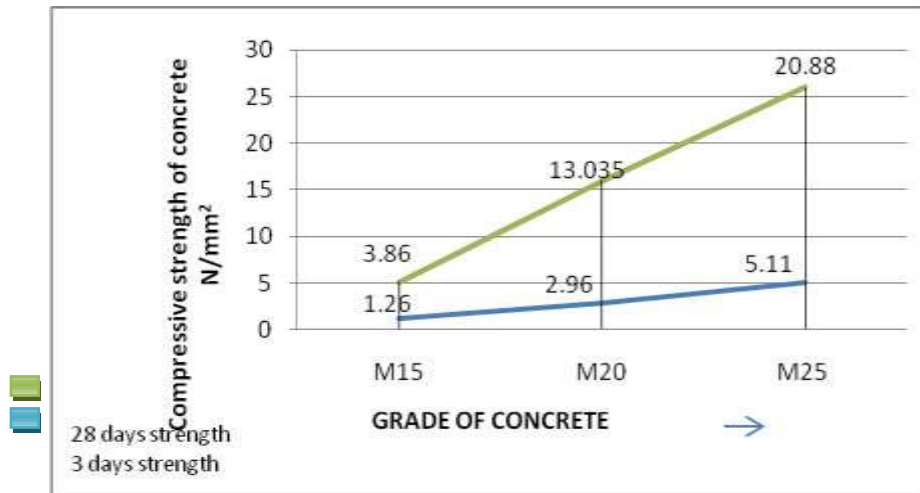
S.N.	Grade of concrete	Load (kN)	Compressive strength (N/mm <sup>2</sup> )
1	M15	30	1.33
		30	1.33
		25	1.11
Average			1.26
2	M20	60	2.67
		70	3.11
		70	3.11
Average			2.96
3	M25	120	5.33
		110	4.88
		115	5.11
Average			5.11

#### Compressive strength of pervious concrete (28 days curing) -

S.N.	Grade of concrete	Load (kN)	Compressive strength (N/mm <sup>2</sup> )
1	M15	70	3.11
		90	4
		100	4.44
Average			3.85
2	M20	270	12
		300	13.33
		310	13.77
Average			13.035
3	M25	460	20.44
		480	21.33
		470	20.88
Average			20.88

#### Characteristic strength of concrete according to IS456:2000

S.N	Grade of concrete	Characteristic strength of concrete at 28 days curing in N/mm <sup>2</sup>
1	M15	15
2	M20	20
3	M25	25



## 8. CONCLUSION

From test result it is clear that the compressive strength of concrete is decrease when sand is omitted from the concrete therefore pervious concrete is suitable for footpaths and others pavement where no heavy vehicles runs. By using of pervious concrete rain water percolates in earth and recharge ground water.

## 9. REFERENCES

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